PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	**Bruesselbach, Hans W.; et al.**	Examiner:	Peace, Rhonda S.
Serial No.:	**10/759,511**	Art Unit:	2874
Filed:	January 15, 2004	Our Ref:	B-4759NP 621649-7
For:	"METHOD AND APPARATUS FOR COMBINING LASER LIGHT"	Date:	March 20, 2008
		Re:	***Appeal to the Board of Appeals***

BRIEF ON APPEAL

Mail Stop Appeal-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the final office action mailed on August 6, 2007 for the above identified patent application. The notice of appeal was filed on December 20, 2007. This appeal brief is timely, with a one month extension of time.

REAL PARTY IN INTEREST

The present application has been assigned to HRL Laboratories, LLC, of Malibu, California, a Limited Liability Company formed under the laws of the State of Delaware.

RELATED APPEALS AND INTERFERENCES

On August 1, 2006 a Notice of Appeal of the final rejection dated May 5, 2006 was filed in this application. The required Appeal Brief was then filed on

October 2, 2006. A Notice of Non-Compliant Appeal Brief issued on October 25, 2006. A corrected Appeal Brief was then filed on November 3, 2006. In view of arguments contained in the corrected Appeal Brief being found persuasive, the final rejection of May 5, 2006 was withdrawn and prosecution reopened.

Appellant is unaware of any other prior and pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1-5, 7-14, 16, 17, 19-28, 30 and 31 are pending in the present application. Claim 18 was cancelled without prejudice in response to the Office Action issued on July 25, 2005. Claims 6, 15, and 29 were cancelled without prejudice in response to the Office Action issued on January 29, 2007. Claims 1-5, 7-14, 16, 17, 19-28, 30 and 31 are the subject of this appeal and are reproduced in the accompanying claims appendix.

STATUS OF AMENDMENTS

No amendment after final rejection has been entered. In the Advisory Action mailed November 27, 2007 the Examiner indicates that "proposed amendments" were filed after final rejection, but will not be entered. Appellants wish to point out that the Response After Final filed on November 6, 2007 did not include any amendments.

SUMMARY OF CLAIMED SUBJECT MATTER

The present application is related to and claims the benefit of United States

Provisional Patent Application Serial No. 60/441,026, filed on Jan. 17, 2003 and titled "Method and Apparatus for Combining Laser Light."

The subject matter of the present application also claims the benefit of United States Provisional Patent Application Serial No. 60/441,027, filed on Jan. 17, 2003 and titled "Method and Apparatus for Coherently Combining Multiple Laser Oscillators."

The subject matter of the present application may also be related to co-pending U.S. patent application Ser. No. 10/759,510, filed on January 15, 2004 and in which a Notice of Allowance was mailed on January 2, 2008, which relates to method and apparatus for coherently combining multiple laser oscillators.

The present application relates generally to combining laser light, i.e., coherent light, in fibers and, more particularly, to a method and apparatus for combining laser light in a fiber bundle. In the fields of optical communication and lasers, particularly high power lasers, it is desirable to provide apparatus and methods for combining multiple optical sources into a single optical output and/or to provide multiple optical outputs from a single optical source.

Independent Claims

The independent claims involved in this appeal are claims 1, 5, 11, 14, 20, 27, and 28. With reference to Figures 1, 1A, 2A, 2B, 2C, 5A, 5B 6A and 6B of the instant application, reproduced below:

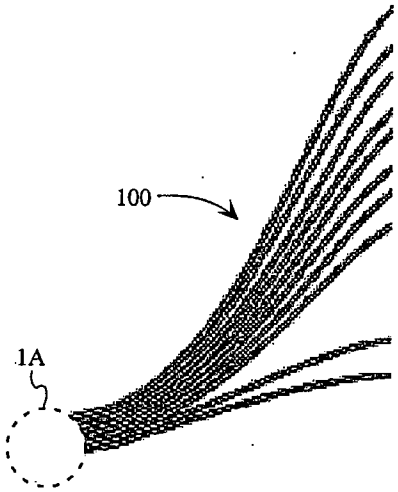

FIG. 1

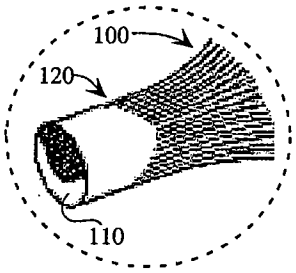

FIG. 1A

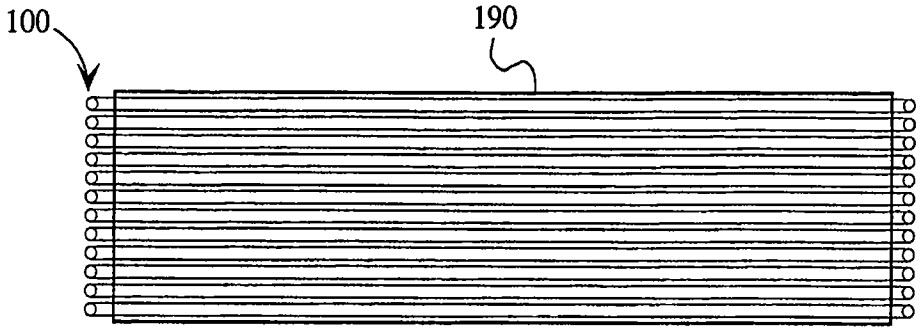

FIG. 2A

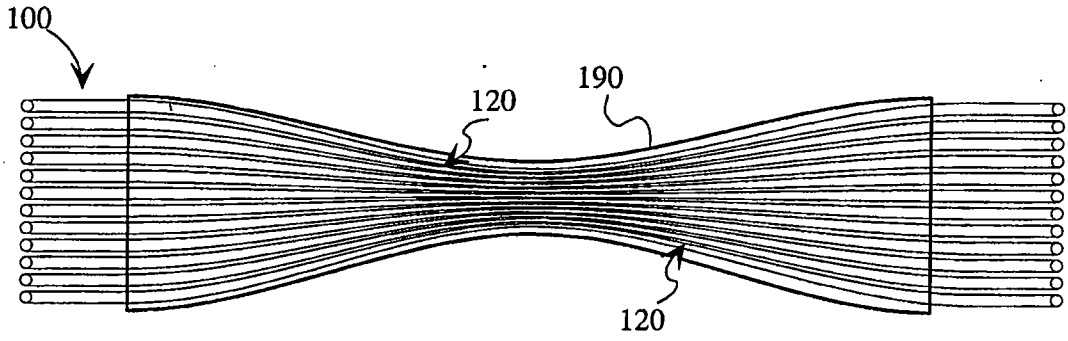

FIG. 2B

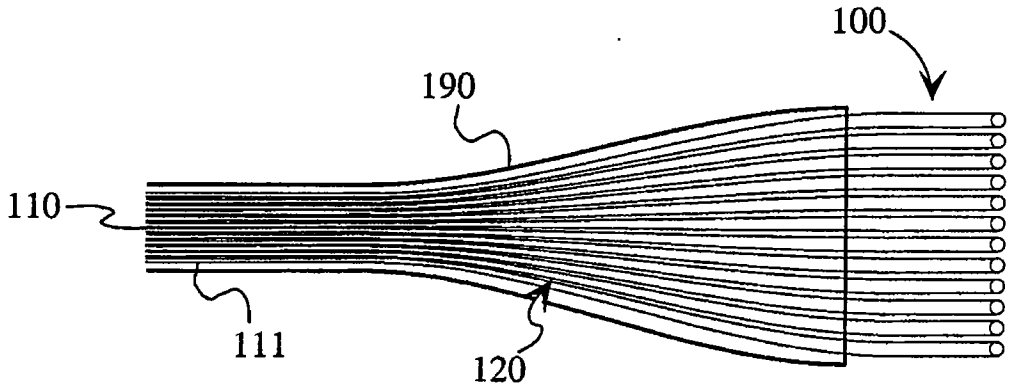

FIG. 2C

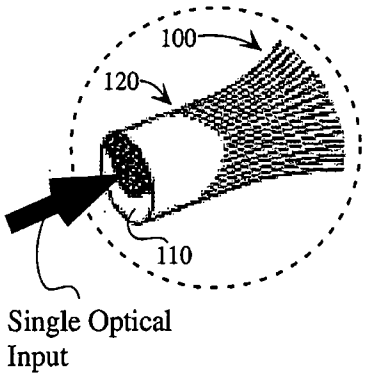

FIG. 5A

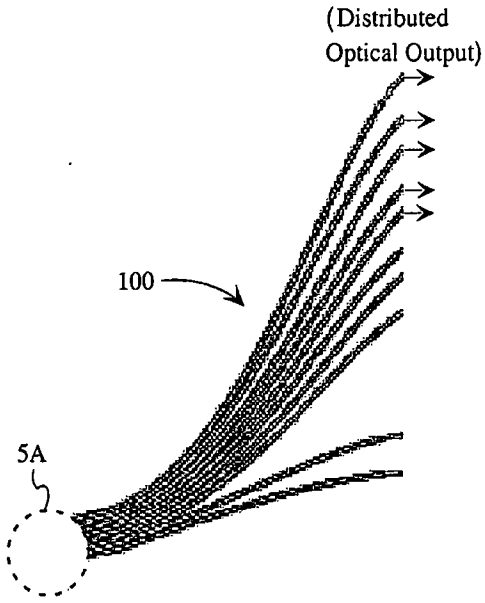

FIG. 5B

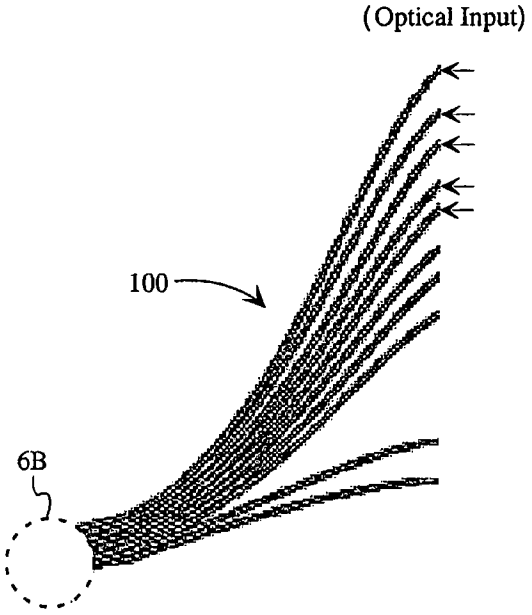

FIG. 6A

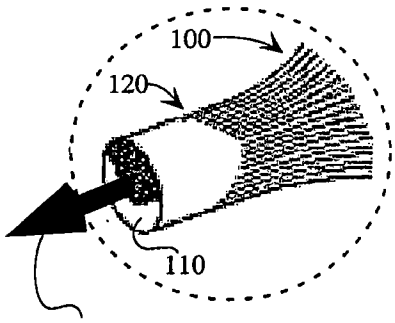

FIG. 6B

Independent Claim 1

Claim 1 provides: "*A fiber optic apparatus comprising:*

a plurality of optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *wherein the second end of the fibers are detached from each other* (see for example Fig. 1)

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by* cutting and polishing or by

cleaving *said tapered region in a direction perpendicular to said fiber axis; said facet having a cross section other than approximately equal to the cross section an individual single-mode fiber*".

Independent Claim 5

Claim 5 provides: "*A fiber optic apparatus comprising:*

a plurality of optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification); *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cutting and polishing or by cleaving said tapered region;*

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber (see for example paragraph [0037], page 8, line 27 to page 9, line 8 of the specification); *and*

wherein each optical fiber is adapted to receive an optical input from a plurality of optical inputs at the second end; and wherein the plurality of optical inputs are emitted into free space at the facet as a single combined optical output fiber" (see for example Figs. 6A and 6B and paragraph [0046], page 11, lines 20-21, of the specification).

Independent Claim 11

Claim 11 provides: "*A method for coupling light comprising:*

providing a plurality of optical fibers (100 see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end, a second end, and a central core extending between the first and second end;*

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section (111, see for example paragraph [0035], page 7, line 27 to page 8, line 5 of the specification);

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber (see for example paragraphs [0036] to [0038], page 8, line 7 to page 9, line 16 of the specification);

forming a facet (110, see for example paragraph [0033], page 7, lines 5-12 of the specification) *by cleaving or cutting and polishing said fused section in a direction perpendicular to the core; and*

illuminating the facet with the light, wherein said illuminating further comprises:

illuminating the facet with a single optical input traveling in free space (see for example Fig. 5A and paragraph [0033], page 7, lines 7-9 of the specification); *and*

distributing the single optical input amongst each optical fiber in the plurality of optical fibers to provide a plurality of distributed optical outputs" (see for example Fig. 5B and paragraph [0045], page 11, lines 15-18 of the specification).

Independent Claim 14

Claim 14 provides: "*A method for coupling light comprising:*

providing a plurality of optical fibers (100 see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end, a second end, and a central core extending between the first and second end;*

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section (111, see for example paragraph [0035], page 7, line 27 to page 8, line 5 of the specification);

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber (see for example paragraphs [0036] to [0038], page 8, line 7 to page 9, line 16 of the specification);

forming a facet (110, see for example paragraph [0033], page 7, lines 5-12 of the specification) *by cutting and polishing or by cleaving said fused section in a direction perpendicular to the core; and*

illuminating the facet with the light, wherein said illuminating further comprises:

providing an optical input at the second end of each optical fiber; and

emitting the optical inputs as a single combined optical output at the facet into free space" (see for example Figs. 6A and 6B and paragraphs [0033], page 7, lines 8-9, [0034], page 7, lines 23-25, and [0046], page 11, lines 20-21, of the specification).

Independent Claim 20

Claim 20 provides: "*An apparatus for coupling light comprising:*

a plurality of single mode optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification); *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cutting and polishing or by cleaving the tapered region in a direction perpendicular to said fiber axis, wherein the facet is adapted to receive a single optical input, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber* (see for example paragraph [0046], page 11, line 20 to page 12, line 7 of the specification); *said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber*".

Independent Claim 27

Claim 27 provides: "*A fiber optic apparatus comprising:*

a plurality of single mode silica (see for example paragraph [0036], page 8, line 7-25 of the specification) *optical fibers* (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111,

see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification); *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis; wherein said facet has a cross section other than approximately equal to the cross section of an individual single-mode fiber*".

Independent Claim 28

Claim 28 provides: "*A fiber optic apparatus comprising:*

a plurality of optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification); *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cutting and polishing or by cleaving said tapered region;*

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber (see for example paragraph [0037], page 8, line 27 to page 9, line 8 of the specification); *wherein the*

facet is adapted to receive a single optical input traveling in free space, the fibers having each a core and a cladding and a mode shape, the sum of the mode shapes of the fibers being calculated, and the core/cladding size ration and stretch being selected, to maximize coupling of the free space beam into the core ensemble; the single optical input being distributed amongst each optical fiber in the plurality of optical fibers" (see for example paragraph [0045], page 11, lines 5-18, of the specification).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Issue 1: Whether claims 1, 9, 20, 21-23, 25-27 and 31 are patentable under 35 U.S.C. § 103(a) over U.S. Patent 6,385,371 to Li ("Li") in view of U.S. Patent 5,408,556 to Wong ("Wong").

Issue 2: Whether claim 24 is patentable under 35 U.S.C. § 103(a) over Li in view of Wong and further in view of U.S. Patent 4,915,467 to Berkey ("Berkey").

Issue 3: Whether claims 5 and 14 are patentable under 35 U.S.C. § 103(a) over Wong in view of U.S. Patent 4,932,747 to Russell, *et al.* ("Russell").

Issue 4: Whether claims 2-4, 8, 10-13, 17, 19, 28 and 30 are patentable under 35 U.S.C. § 103(a) over Wong.

Issue 5: Whether claims 7 and 16 are patentable under 35 U.S.C. § 103(a) over Wong in view of Berkey.

ARGUMENT

Issue 1: The Rejection under 35 U.S.C. § 103(a) over Li and Wong

The Examiner rejects claims 1, 9, 20, 21-23, 25-27 and 31 under 35 U.S.C. § 103(a) as being unpatentable over Li in view of Wong. This rejection should be withdrawn because neither Li nor Wong, singly or in combination, teach or suggest the claimed subject matter.

Independent Claims

Claims 1, 20, and 27 are independent.

Claim 1

In the non-final Office Action dated issued on January 29, 2007 the Examiner rejected claim 1 under 35 U.S.C. § 102(b) as being anticipated by Wong. The pending language of claim 1 was filed on April 30, 2007. Claim 1 recites a "fiber optic apparatus" comprising:

> "a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region, wherein the second end of the fibers are detached from each other; and
>
> a facet, said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis; said facet having a cross section other than

approximately equal to the cross section of an individual single-mode fiber."

In the final Official Action dated August 6, 2007, which is the subject of this appeal, the Examiner no longer relies upon Wong alone. Instead, the Examiner contends that the limitations of claim 1 are either taught by, or inherent to, Li, with the exception of 1) "said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis", and 2) "said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis", which are said to be a teaching of Wong. The Appellants respectfully disagree.

Figure 3 of Li is reproduced below:

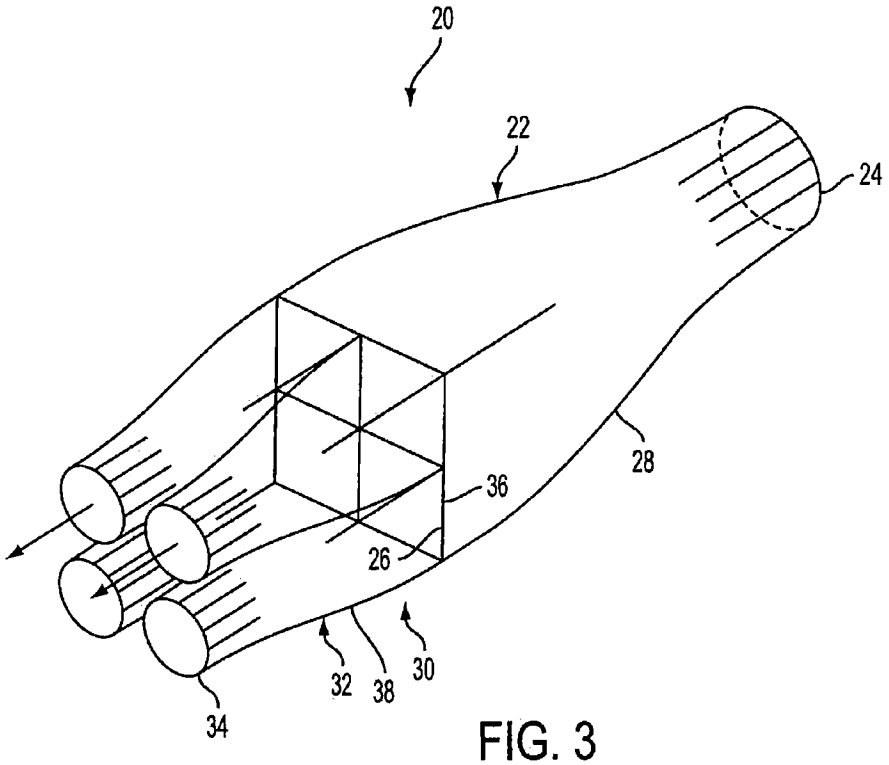

FIG. 3

Li is directed to an **optical coupling** (detail 20, Fig. 3) for joining a **single**

large core fiber **light guide** to multiple **light guides** for **illumination** purposes. Light used for illumination is non-coherent light. Large core light guides "consist of a single highly transparent core material that is covered with a cladding" and are used for "architectural lighting, remote illuminations, and decorative lighting" (column 1, lines 13-158). A practical application of Li's optical coupling is using multiple types of light inputs to achieve a desirable light output for illumination: "The lamps used as the inputs [to the optical coupling] ... may be different, and different types of lamps may be combined to achieve output characteristics. For example, combining a mercury lamp and a sodium lamp can give an output that is closer to daylight than the bluish mercury lamp or the yellowish sodium lamp" (column 8, lines 31-36).

Li seeks to address known problems of single-to-multiple optical light guide coupling schemes, including non-uniform splitting of light energy among the multiple light guides and/or excessive light losses (see for example column 1, lines 24-27).

The Examiner looks to Li's Figure 3 as showing multiple optical fibers (referencing detail 32), "having a first end and second detached ends 34, where the fibers 32 are tapered, as seen in Figure 3, to form a tapered region 28, and a facet 24 formed upon said tapered region 28 in a direction perpendicular to the optical axis of said fibers 32". The Examiner then cites to large blocks of text in Li (column 3, lines 51-67, column 4, lines 1-67, and column 5, lines 1-59) without identifying where in the text such is disclosed.

With reference to Figure 3, above, and column 3, lines 51-59, Li's optical coupling 20 comprises a first coupler 22 and a second coupler 30. "The first coupler 22 is in optical communication with the second coupler 30 so that light may be transmitted from the first coupler 22 to the second coupler 30, or vice

versa, through" a "common plane" (column 4, lines 50-53).

The first coupler 22 includes a first transmitting section 24 that "comprises a section of a **single fiber light guide**" that receives light from a single light source or from a single fiber input. The first coupler 22 also has a first transition section 28 that connects first transmitting section 24 to a first interface surface 26 (see for example column 4, lines 8-22). The **single** fiber light guide of transmitting section 24 is clearly not "a **plurality** of optical fibers" as required by claim 1. As well, transition section 28 is not a "plurality" of anything, let alone "a plurality of optical fibers".

The second coupler 30 comprises multiple "**individual single fiber light guides** 32 arranged in mutual juxtaposition of one another" (column 4, lines 27-29). That is, the individual single fiber light guides 32 are in "a side-by-side position." "juxtaposition." *WordNet® 3.0*. Princeton University. 15 Feb. 2008. <Dictionary.com http://dictionary.reference.com/browse/juxtaposition>. Each **individual single fiber light guide** 32 includes a second transmitting section 34, a second interface surface 36, and a second transition section 38 that connects the second transmitting section 34 to the second interface surface 36 (see for example column 4, lines 27-37).

The "common plane" for light transmission referenced above is between the **one** interface surface of the first coupler 22 ("first interface surface 26") and the **multiple** interface surfaces of the second coupler 30 ("second interface surface 36" of each of the individual single fiber light guides 32). In the example of Figure 3, there are four **individual single fiber light guides** 32 **each** having a specially formed square-shaped second interface surface 36 that covers one-quarter of the first interface surface 26. The specially formed square shape both 1) provides for uniform distribution of light among the four individual single

fiber light guides 32, and 2) minimizes light loss due to gaps between the light guides 32 at the "common plane" with the first coupler 30 (see for example column 4, line 59, through column 5, line 8, and column 5, lines 29-52). Thus, at best, Li discloses a plurality of specially formed individual single fiber light guides 32, not "a plurality of optical fibers" as required by claim 1.

As can best be understood, the Examiner is of the opinion that the first transition section 28 is formed of multiple individual single fiber light guides 32 somehow bundled or otherwise put together to form a tapered region. As will be clear from the discussion of first coupler 22 above, Li in no way teaches or suggests such.

Each one of the multiple light guides 32 is an "**individual** single fiber light guide." The multiple individual single fiber light guides 32 are arranged in mutual juxtaposition, i.e., side-by-side, as discussed above and clearly shown in Figure 3. At most, the second interface surfaces 36 of each light guide 32 abut at the "common plane." However, no other portions of the multiple individual single fiber light guides 32 touch. Thus, the multiple individual single fiber light guides 32 are in no way bundled or otherwise put together to form a tapered region.

Furthermore, the light guides 32 belong to the second coupler 30, not the first coupler 22. Each one of the multiple individual single fiber light guides 32 terminates at its respective second interface surface 26, and the second coupler 30 as a whole ends at the multiple second interface surfaces 26. Thus, the light guides 32 are necessarily separate and distinct from the first coupler 22 and its first transition section 28.

Further regarding the first transition section 28 that the Examiner considers formed of the multiple individual single fiber light guides 32, the first

transition section 28 lies between first interface surface 36 and first transmitting section 24 of the first coupler 22. As discussed above, the first transmitting section 24 that is adjacent to the transition section 28 "comprises a section of a single fiber light guide." Thus, at most, first transition section 28 might be somehow formed from one single fiber light guide, but clearly not from a plurality of single fiber light guides.

To be clear, Li does not teach or suggest the plurality light guides 32 bundled or put together in any manner, let alone the required "plurality of (fused) optical fibers being tapered to form a tapered region" of claim 1.

The Examiner is also of the opinion that Figure 3 discloses "a facet 24 formed upon said tapered region 28" of the multiple single fiber light guides 32. Detail 24 is the "first transmitting section" of first coupler 22. First transmitting section 24 "comprises **a** section of a single fiber light guide that receives light from a single light source or from a **single** fiber input. Alternatively, the transmitting section 24 transmits light in an opposite direction toward to a **single** fiber output or other illumination device" (column 3, lines 56-61). Unquestionably, first transmitting section 24 is not formed from, nor does it include, a plurality light guides. Thus, even if first transmitting section 24 includes a facet, which is not disclosed, such a facet would be formed in **one** single fiber light guide, not a plurality of single fiber light guides.

To be clear, Li does not teach or suggest a facet formed in a tapered region of a plurality of bundled light guides, let alone the required "facet being formed" in "said tapered region" of a fused plurality of optical fibers, "said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber" as also required by claim 1.

The Examiner also argues that Li "inherently" includes the recited "facet

having a cross section other than approximately equal to the cross section of an individual single-mode fiber" because "facet 24 may be formed in various sizes and shapes." "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original).

Since, as discussed above, Li fails to teach or suggest a facet formed in a tapered region of a fused plurality of light guides **or** optical fibers, a facet formed in a tapered region of a fused plurality of optical fibers and "having a cross section other than approximately equal to the cross section of an individual single-mode fiber" **necessarily cannot flow** from the teachings of Li. Thus, the asserted inherency of "said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber" in Li necessarily has not been established, nor can it be.

In view of the above, Appellants heartily agree with the Examiner that Li fails to teach or suggest 1) the required "plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis", and 2) the required "said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis.

The Examiner relies upon Wong to cure the acknowledged deficiency. Figure 5 of Wong is reproduced below:

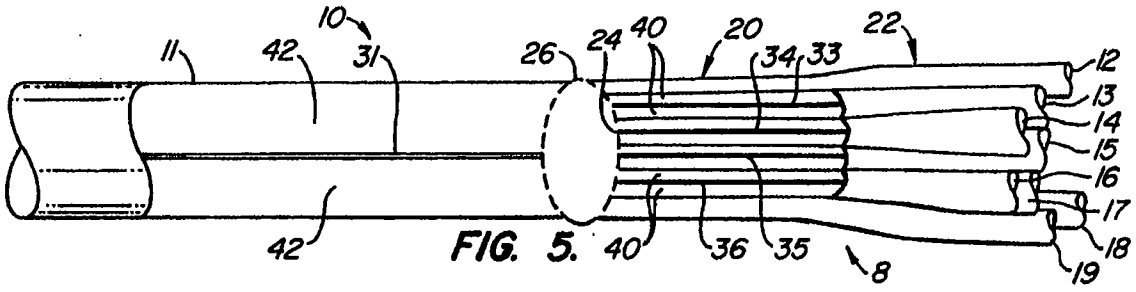

FIG. 5.

Wong is directed to "couplers for optical fibers used in communication cables" (column 1, lines 6-7). Wong discloses a 1xN splitter (10) for single-mode optical fiber that includes an individual single-mode optical fiber (11) having its junction end juxtaposed, through a focusing lens/junction element (26), to the end of a bundle (8) of arbitrarily arranged single-mode fibers (12-19) which are fused together along a portion of their lengths (20) and which have a total diameter approximately equal to the diameter of the first single-mode fiber.

In the response filed April 30, 2007, Appellants noted that Wong recites in its claim 1 that "the bundle has a total diameter approximately equal to the diameter of said individual single-mode fiber." The other independent claims (claim 4 and claim 6) of Wong recite similar features. The Appellants also noted that a bundle having a total diameter approximately equal to the diameter of an individual single-mode fiber will necessarily have a cross section approximately equal to the cross section of an individual single-mode fiber.

Appellants further noted that claim 1, as amended in that response, recites a facet "having a cross section other than approximately equal to the cross section of an individual single-mode fiber", and claim 1 therefore cannot be anticipated by Wong.

Still further, the Appellants noted that since the feature of the bundle

having a total diameter approximately equal to the diameter of an individual single-mode fiber is common to all three independent claims of Wong, such feature is essential to the invention of Wong and a device not having such feature is not within the scope of the disclosure of Wong. The Appellants also noted that such device lacking an essential feature of the invention of Wong, and not being within the scope of the disclosure of Wong, can in particular not be deemed to perform satisfactorily the intended purpose of the invention of Wong.

Appellants concluded that it follows that one cannot argue that there is any suggestion or motivation in the art to modify the invention of Wong to have a bundle with a diameter different from the diameter of an individual single-mode fiber, because such modified device lacks an essential feature of Wong's invention and is not within the scope of Wong's disclosure and is thus unsatisfactory for the intended purpose of Wong's invention.

The Examiner has at least implicitly acknowledged the Appellants observations on rejecting claim 1 based upon Wong alone, as the Examiner no longer exclusively relies upon Wong in rejecting claim 1, but instead looks to a combination of Li and Wong in making the instant rejection.

The Examiner states that it would have been obvious "to use a fusing method to form the tapered section of Li's apparatus, as Wong discloses the fusing method is an easy method by which to form a tapered bundle." The Examiner also states that it would have been obvious to form Li's facet by a cleaving method, as Wong discloses cleaving is an easy way to construct such a facet that is capable of effective light transmission".

It is respectfully noted that since Li fails to teach or suggest 1) a plurality of light guides **or** optical fibers bundled or otherwise put together to form a tapered region, or 2) a facet formed in such a tapered region, any fusing or

cleaving that may be taught by Wong cannot and would not result in the claimed invention, even assuming motivation to combine Wong with Li, or that such a combination is possible. Wong fails to cure the deficiencies of Li, both those acknowledged by the Examiner and those noted by the Appellants herein.

If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. See, e.g., *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. See, e.g., *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

The intended purpose and principle of operation of Li is to provide multiple light outputs from a single light input, or vice-versa (See for example column 1, lines 7-10). The only things disclosed by Li that could possibly be fused together and cleaved are the multiple individual single fiber light guides 32. Such a fusing would eliminate the multiplicity of Li, resulting in Li's coupler providing, at best, a single light output from a single light input. This would both render Li's optical coupler unsatisfactory for its intended purpose and change its principle of operation. Thus, at least for this reason, there could be no motivation to make the proposed combination. And, also at least for this reason, even if motivation could somehow be established, which is not the case, the teachings of Li and Wong are not sufficient to render claim 1 *prima facie* obvious.

Further still, Li is directed to the field of **illumination, i.e., lighting,** and provides optical couplers for transmitting visible, i.e., non-coherent, light for such applications as architectural lighting, remote illuminations, and decorative

lighting, as discussed above. On the other hand, Wong is directed to field of **optical communications, i.e., optical signals,** and provides optical couplers for transmitting laser light, i.e., coherent light, carrying communication signals (see for example, column 1, lines 6-7). Thus, Li and Wong are in different fields. The Examiner has provided no rationale as to why one in the field of lighting would be motivated look to Wong, in the field of communications, to improve upon or otherwise modify that taught by Li. For this reason also, the Examiner has failed to establish motivation.

The Examiner has not established a *prima facie* case of obviousness at least because the combination of Li and Wong, whether or not a teaching, suggestion or motivation to combine exists, does not teach or suggest the claimed subject matter of claim 1. M.P.E.P. § 2143.03 ("To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art").

The rejection of claim 1 under 35 U.S.C. § 103(a) should be reversed and withdrawn.

Claim 20

Claim 20 recites an "apparatus for coupling light" requiring:

> "a plurality of single mode optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and
>
> a facet, said facet being formed by cutting and polishing or by cleaving the tapered region in a direction perpendicular to said fiber axis, wherein the facet is adapted to receive a single optical

> input, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber; said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber."

The Examiner rejects claim 20 on essentially the same grounds as the rejection of claim 1, stating that the limitations of claim 20 are disclosed by, or inherent to, Li, with the exception of 1) the recited fusing, 2) the facet being formed by cutting and polishing, or cleaving, and 3) each of the plurality of optical fibers being single mode optical fibers, which are said to be a teaching of Wong. The Appellants respectfully disagree.

Claim 1 and claim 20 each require a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and a facet, said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis, said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber.

For the reasons discussed above, the **single** fiber light guide of Li's transmitting section 24 is clearly not a **plurality of** light guides **or** optical fibers, let alone a "plurality of single mode optical fibers" as required by claim 20. As well, transition section 28 is not a "plurality" of anything.

Also for the reasons discussed above, Li's multiple specially formed

individual single fiber light guides 32 of second coupler 30 are not optical fibers, let alone a "**plurality** of single mode optical fibers" as required by claim 20.

And again, for the reasons discussed above, Li does not teach or suggest the multiple individual single fiber light guides 32 bundled or otherwise put together to form a tapered region, let alone the required "plurality of (fused single mode) optical fibers being tapered to form a tapered region" of claim 20.

Li also does not teach or suggest a facet formed in a tapered region of a plurality of bundled light guides, let alone the required "facet being formed" in "said tapered region" of a fused plurality of single mode optical fibers, "said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber" as required by claim 20, for the same reasons put forth above regarding claim 1.

And again, since Li fails to teach or suggest a facet formed in a tapered region of a fused plurality of light guides **or** optical fibers, then a facet formed in a tapered region of a fused plurality of any optical fibers, including single mode optical fibers, and "having a cross section other than approximately equal to the cross section of an individual single-mode fiber", as recited in claim 20, **necessarily cannot flow** from the teachings of Li, and thus the inherency asserted by the Examiner regarding the cross-section necessarily has not been established, nor can it be.

Regarding the fusing and cutting and polishing, or cleaving the Examiner acknowledges are lacking in Li, it is again respectfully noted that since Li fails to teach or suggest 1) a plurality of light guides **or** optical fibers bundled or otherwise put together to form a tapered region, or 2) a facet formed in such a tapered region, any fusing or cleaving that may be taught by Wong cannot and

would not result in the claimed invention, even assuming motivation to combine Wong with Li, or that such a combination is possible. Wong fails to cure these acknowledged deficiencies of Li, as well as the deficiencies of Li noted by the Appellants herein.

Also, for the reasons set forth above, the Examiner's proposal to modify Li with Wong's fusing and cleaving could only result in rendering Li's optical coupler unsatisfactory for its intended purpose, as well as changing its principle of operation. Accordingly, there could be no motivation to make the proposed combination. And, even if motivation for the proposed combination could somehow be established, which is not the case, the teachings of Li and Wong are not sufficient to render claim 20 *prima facie* obvious.

Further still, for the reasons discussed above, motivation to make the proposed combination is lacking because the Examiner has provided no rationale as to why one in the field of lighting would be motivated look to Wong, in the field of communications, to improve upon or otherwise modify that taught by Li.

Regarding single mode fibers, the Examiner argues that his proposed modification to replace Li's light guides with Wong's single mode optical fibers would have been obvious because "Li does not limit their coupler to any particular type of fiber." It is respectfully submitted that, contrary to the assertion of the Examiner, Li does in fact limit his coupler. As discussed above, Li limits his coupler to use with large core optical fibers, which are for illumination/lighting purposes. As would be understood by one skilled in the art, single mode fibers are not suitable for illumination/lighting purposes. At least for this reason, the Appellants respectfully submit that claim 20 is patentable over the Li and Wong combination.

The Appellants respectfully remind the Examiner that section 2143.01 of

the MPEP provides that "**Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art**".

Appellants respectfully submit that the Examiner has failed to show that "there is some teaching, suggestion, or motivation", "either in the references themselves or in the knowledge generally available to one of ordinary skill in the art", to replace Li's illuminating large core optical fibers with Wong's signal transmitting single-mode fibers.

In summary, Appellants note that the Examiner has failed to show that there is any suggestion in Li or in the art to use single-mode fibers. Appellants further note that using single mode fibers in Wong would have made the device of Li unsatisfactory for its intended purpose of coupling light for illumination purposes. Appellants therefore respectfully submit that the Examiner has failed to show that it would have been obvious to modify the teachings of Li to obtain an apparatus as recited in claim 20, and in particular comprising "*a plurality of single mode optical fibers*", and submit that claim 20 is patentable over Li and Wong, whether taken individually or in combination, whereby the Examiner's rejection should be properly overturned.

Accordingly, the Examiner has again not established a *prima facie* case of obviousness at least because the combination of Li and Wong, whether or not a teaching, suggestion or motivation to combine exists, does not teach or suggest the claimed subject matter of claim 20. M.P.E.P. § 2143.03 ("To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art").

The rejection of claim 20 under 35 U.S.C. § 103(a) should be reversed and withdrawn.

Claim 27

Claim 27 recites a "fiber optic apparatus" requiring:

> "a plurality of single mode silica optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and
>
> a facet, said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis; wherein said facet has a cross section other than approximately equal to the cross section of an individual single-mode fiber."

The Examiner rejects claim 27 on essentially the same grounds as claim 20, stating that the limitations of claim 27 are disclosed by, or are inherent to, Li, with the exception of 1) the recited fusing, 2) the facet being formed by cutting and polishing, or cleaving, and 3) each of the plurality of optical fibers being single mode optical fibers, which is said to be a teaching of Wong. The Appellants respectfully disagree.

It is first noted that claim 27 requires "a plurality of single mode silica optical fibers." The Examiner has seemingly ignored the requirement that the single mode optical fibers be **silica** fibers. Neither Li nor Wong teach silica fibers. Thus, for this reason alone, the rejection of claim 27 is inappropriate.

Claim 1 and claim 27 each require a plurality of optical fibers, each optical

fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and a facet, said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis, said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber.

For the reasons discussed above, the **single** fiber light guide of Li's transmitting section 24 is clearly not a **plurality of** light guides **or** optical fibers, let alone a "plurality of single mode silica optical fibers" as required by claim 27. As well, transition section 28 is not a "plurality" of anything.

Also for the reasons discussed above, Li's multiple specially formed individual single fiber light guides 32 of second coupler 30 are not optical fibers, let alone a "**plurality** of single mode silica optical fibers" as required by claim 27.

And again, for the reasons discussed above, Li does not teach or suggest the multiple individual single fiber light guides 32 bundled or otherwise put together to form a tapered region, let alone the required "plurality of (fused single mode silica) optical fibers being tapered to form a tapered region" of claim 27.

Li also does not teach or suggest a facet formed in a tapered region of a plurality of bundled light guides, let alone the required "facet being formed" in "said tapered region" of a fused plurality of single mode silica optical fibers, "said facet has a cross section other than approximately equal to the cross section of an individual single-mode fiber" as required by claim 27, for the same reasons put forth above regarding claim 1.

And again, since Li fails to teach or suggest a facet formed in a tapered region of a fused plurality of light guides **or** optical fibers, then a facet formed in a tapered region of a fused plurality of any optical fibers, including single mode silica optical fibers, and "having a cross section other than approximately equal to the cross section of an individual single-mode fiber", as recited in claim 27, **necessarily cannot flow** from the teachings of Li, and thus the inherency asserted by the Examiner regarding the cross-section necessarily has not been established, nor can it be.

Regarding the fusing and cutting and polishing, or cleaving the Examiner acknowledges are lacking in Li, it is again respectfully noted that since Li fails to teach or suggest 1) a plurality of light guides **or** optical fibers bundled or otherwise put together to form a tapered region, or 2) a facet formed in such a tapered region, any fusing or cleaving that may be taught by Wong cannot and would not result in the claimed invention, even assuming motivation to combine Wong with Li, or that such a combination is possible. Wong fails to cure these acknowledged deficiencies of Li, as well as the deficiencies of Li noted by the Appellants herein.

Also, for the reasons set forth above, the Examiner's proposal to modify Li with Wong's fusing and cleaving could only result in rendering Li's optical coupler unsatisfactory for its intended purpose, as well as changing its principle of operation. Accordingly, there could be no motivation to make the proposed combination. And, even if motivation for the proposed combination could somehow be established, which is not the case, the teachings of Li and Wong are not sufficient to render claim 27 *prima facie* obvious.

Further still, for the reasons discussed above, motivation to make the proposed combination is lacking because the Examiner has provided no rationale

as to why one in the field of lighting would be motivated look to Wong, in the field of communications, to improve upon or otherwise modify that taught by Li.

Regarding single mode fibers, the Examiner argues that his proposed modification to replace Li's light guides with Wong's single mode optical fibers would have been obvious because "Li does not limit their coupler to any particular type of fiber." It is respectfully submitted that, contrary to the assertion of the Examiner, Li does in fact limit his coupler. As discussed above, Li limits his coupler to use with large core optical fibers, which are for lighting purposes. As would be understood by one skilled in the art, single mode fibers are not suitable for lighting purposes. At least for this reason, the Appellants respectfully submit that claim 27 is patentable over the Li and Wong combination.

The Appellants respectfully remind the Examiner that section 2143.01 of the MPEP provides that "**Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art**".

Appellants respectfully submit that the Examiner has failed to show that "there is some teaching, suggestion, or motivation", "either in the references themselves or in the knowledge generally available to one of ordinary skill in the art", to replace Li's illuminating large core optical fibers with Wong's signal transmitting single-mode fibers.

In summary, Appellants note that the Examiner has failed to show that there is any suggestion in Li or in the art to use single mode fibers, let alone single mode silica fibers. Appellants further note that using single mode fibers in

Wong would have made the device of Li unsatisfactory for its intended purpose of coupling light for illumination purposes. Appellants therefore respectfully submit that the Examiner has failed to show that it would have been obvious to modify the teachings of Li to obtain an apparatus as recited in claim 27, and in particular comprising *"a plurality of single mode **silica** optical fibers"*, and submit that claim 27 is patentable over Li and Wong, whether taken individually or in combination, whereby the Examiner's rejection should be properly overturned.

The Examiner has not established a *prima facie* case of obviousness at least because the combination of Li and Wong, whether or not a teaching, suggestion or motivation to combine exists, does not teach or suggest the claimed subject matter of claim 27. M.P.E.P. § 2143.03 ("To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art").

The rejection of claim 27 under 35 U.S.C. § 103(a) should be reversed and withdrawn.

Dependent Claims

Claim 9 depends from independent claim 1.

Claims 21, 22, 23, 25 and 26 depend from independent claim 20.

Claim 31 depends from independent claim 27.

The rejections of these claims under 35 U.S.C. § 103(a) are all based on Li in view of Wong. Claim 9 is allowable as a dependent claim at least in view of the allowability of claim 1 over these references and without considering the additional limitations added by claim 9. Claims 21, 22, 23, 25 are 26 are allowable as dependent claims at least in view of the allowability of claim 20 over these references and without considering the additional limitations added by

these claims. Claim 31 is allowable as a dependent claim at least in view of the allowability of claim 27 over these references and without considering the additional limitations added by claim 31.

Claim 9

Appellants submit that claim 9, in addition to being allowable based upon its dependency on claim 1, is allowable on its own merits.

Claim 9 recites "*The apparatus of claim 1, wherein the plurality of optical fibers disposed in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber*".

The Examiner argues that "even signal distribution among the plurality of optical fibers 32 is a stated goal of Li", and thus claim 9 is disclosed by Li. It is respectfully noted that the relied upon portion of Li, column 2, lines 6-11, does not recite that which the Examiner asserts. Rather, Li states that a need exists for a coupling for transmitting light (not a signal) between one single fiber light guide and multiple single fiber light guides "that avoids losses due to interfiber gaps and also avoids fiber to fiber output power variations" (column 2, lines 6-11). Li, again, does not disclose a fused fiber bundle, let alone the recited uniform stretching of claim 9. In fact, Li discloses no stretching of any kind whatsoever.

The Section 103(a) rejection of claim 9 over Li in view of Wong should be reversed and withdrawn.

Claim 21

Appellants submit that claim 21, in addition to being allowable based upon its dependency on claim 20, is allowable on its own merits.

Claim 21 requires: "wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays".

The Examiner contends that the limitations of claim 21 are taught by Li's Figure 3. The Appellants respectfully disagree. The Examiner asserts that "figure 3 of Li shows said fibers 32 are formed within a square close packed array." As discussed above, the light guides 32 are not optical fibers, nor are they in a "packed array" of any kind. Light guides 32 are separate and individual, for transmitting illuminating light to separate locations.

The Section 103(a) rejection of claim 21 over Li in view of Wong should be reversed and withdrawn.

Claim 22

Appellants submit that claim 22, in addition to being allowable based upon its dependency on claim 20, is allowable on its own merits.

Claim 22 requires: "wherein the plurality of optical fibers are provided in a glass matrix."

The Examiner contends that the limitation of claim 22 is taught by Wong. The Appellants respectfully disagree. In particular, the Examiner argues that "Wong discloses the fibers are provided in a glass matrix 53 during the tapering process." Appellants note that detail 53 of Wong is not a glass matrix, but rather is a "quartz tube" (column 5, line 7).

The Section 103(a) rejection of claim 22 over Li in view of Wong should be reversed and withdrawn.

Claim 23

Appellants submit that claim 23, in addition to being allowable based upon its dependency on claim 20, is allowable on its own merits.

Claim 23 recites: "The apparatus of claim 20, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region". The Examiner is of the opinion that the requirements of claim 23 are inherent to Wong. The Appellants respectfully disagree.

The Examiner argues "in the fusing and stretching method disclosed above by Wong, it is inherent that the core size of a given fiber within the taper portion is smaller than the core diameter of the same given fiber in the non-tapered (non-stretched) portion." Appellants note that the above logic at best relates to the overall dimensions of a fiber optic bundle, and does not relate to the core diameter of the fibers of the bundle. Accordingly, Appellants respectfully submit that the Examiner has failed to show that Wong inherently discloses or suggests that recited in claim 23, and in particular "*wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region*". Appellants submit that for this reason also, claim 23 is patentable over the applied art, whereby the Examiner's rejection should be properly overturned.

The Section 103(a) rejection of claim 23 over Li in view of Wong should be reversed and withdrawn.

Claim 25

Appellants submit that claim 25, in addition to being allowable based upon its dependency on claim 20, is allowable on its own merits.

Claim 25 requires: "the fibers have each a core and a cladding and a mode shape; the plurality of optical fibers in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber; and where the sum of the mode shapes of the fibers is calculated, and the core/cladding size ratio and stretch are selected, to maximize coupling of the free space beam into the core ensemble."

The Examiner acknowledges that both Li and Wong fail to teach or suggest "where the sum of the mode shapes of the fibers is calculated, and the core/cladding size ratio and stretch are selected, to maximize coupling of the free space beam into the core ensemble." To overcome the acknowledged deficiency, the Examiner has chosen to affirmatively ignore these explicitly recited limitations, instead of properly citing and applying art which teaches such.

In particular, the Examiner states "claim 25 only requires the device to be formed such that the coupling of the free space beam is maximized." In support of this position the Examiner relies upon *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ 2d 1429, 1431-32 (Fed. Cir. 1997). It is respectfully asserted that the Examiner has misapplied *Schreiber*. *Schreiber* teaches that an apparatus must be distinguished from the prior art in terms of structure rather than function. The ignored language is not functional language, but rather language that clearly and specifically defines structure of the claimed fiber optic apparatus. Accordingly, the neglected portion of claim 25 should clearly have been considered. As the court stated in *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, "[A]pparatus claims cover what a device *is*, not what a device *does*." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis

in original). Clearly, the ignored language is directed to what the claimed apparatus is, not what the claimed apparatus does. At a minimum, the rejection of claim 25 is improper based upon the Examiner's failure to consider language which defines structure.

Further still, the Examiner even acknowledges that that Li does not explicitly teach that Li's device be formed such that the coupling of a free space beam is maximized, but that such would have been obvious "in order to conserve the optical signal." As explained above, Li does not teach or suggest "optical signals." This is so because Li is directed to the field of optical illumination, not signaling of any sort. Thus, the Examiner's rejection must fall for this reason as well.

The Section 103(a) rejection of claim 25 over Li in view of Wong should be reversed and withdrawn.

Claim 26

Appellants submit that claim 26, in addition to being allowable based upon its dependency on claim 20, is allowable on its own merits.

Claim 26 requires: "wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers."

The Examiner contends that the limitations of claim 26 are taught by Li. The Appellants respectfully disagree.

For example, the Examiner argues "in addition, Li discloses the fibers 32 may be of differing size, as each may have a cross-section that is greater than, equal to, or smaller than, their corresponding interface section 36. See col. 4 lines 28-49." The Examiner's reading of Li is simply mistaken. Li does **not** disclose

that "at least one" of his plurality of light guides 32, which the Examiner mistakenly takes as an optical fiber, has "a different core size and/or refractive index from at least one other" of the plurality of light guides. For this reason alone, the rejection of claim 26 must fall.

The Section 103(a) rejection of claim 26 over Li in view of Wong should be reversed and withdrawn.

Claim 31

Appellants submit that claim 31, in addition to being allowable based upon its dependency on claim 27, is allowable on its own merits.

Claim 31 requires: "where the fibers have each a core and a cladding and a mode shape; where the plurality of optical fibers in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber; and where the sum of the mode shapes of the fibers is calculated, and the core/cladding size ratio and stretch are selected, to maximize coupling of the free space beam into the core ensemble."

The Examiner acknowledges that both Li and Wong fail to teach or suggest "where the sum of the mode shapes of the fibers is calculated, and the core/cladding size ratio and stretch are selected, to maximize coupling of the free space beam into the core ensemble." To overcome the acknowledged deficiency, the Examiner has chosen to affirmatively ignore these explicitly recited limitations, instead of properly citing and applying art which teaches such.

In particular, the Examiner states claim 31 only requires the device to be formed such that the coupling of the free space beam is maximized. In support of this position the Examiner relies upon *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ 2d 1429, 1431-32 (Fed. Cir. 1997). It is respectfully asserted that the

Examiner has misapplied *Schreiber*. *Schreiber* teaches that an apparatus must be distinguished from the prior art in terms of structure rather than function. The ignored language is not functional language, but rather language that clearly and specifically defines structure of the claimed fiber optic apparatus. Accordingly, the neglected portion of claim 31 should clearly have been considered. As the court stated in *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, "[A]pparatus claims cover what a device *is*, not what a device *does*." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original). Clearly, the ignored language is directed to what the claimed apparatus is, not what the claimed apparatus does. At a minimum, the rejection of claim 31 is improper based upon the Examiner's failure to consider language which defines structure.

Further still, the Examiner even acknowledges that that Li does not explicitly teach that Li's device be formed such that the coupling of a free space beam is maximized, but that such would have been obvious "in order to conserve the optical signal." As explained above, Li does not teach or suggest "optical signals." This is so because Li is directed to the field of optical illumination, not signaling of any sort. Thus, the Examiner's rejection must fall for this reason as well.

The Section 103(a) rejection of claim 31 over Li in view of Wong should be reversed and withdrawn.

Issue 2: The Rejection under 35 U.S.C. § 103(a) over Li , Wong and Berkey

The Examiner rejects claim 24 under 35 U.S.C. § 103(a) as being unpatentable over Li in view of Wong and further in view of Berkey. This rejection should be withdrawn because the applied art, Li, Wong, and Berkey,

whether singly or in any combination, fails to teach or suggest the claimed subject matter.

Claim 24 depends from claim 22, which depends from independent claim 20. Claim 24 is allowable as a dependent claim at least in view of the allowability of claim 20 over these references and without considering the additional limitations added by either of claims 22 or 24. Additionally, claim 24 is allowable as a dependent claim in view of the allowability of claim 22 over these references and without considering the additional limitations added by claim 24.

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 7 and 16 are also allowable.

Issue 3: The Rejection under 35 U.S.C. § 103(a) Wong and Russell

The Examiner rejects claims 5 and 14 under 35 U.S.C. § 103(a) as being unpatentable over Wong in view of Russell. This rejection should be withdrawn because neither Wong nor Russell, singly or in combination, teach or suggest the claimed subject matter.

Claim 5

Independent claim 5 is directed to:

"A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a

tapered region; and

a facet, said facet being formed by cutting and polishing or by cleaving said tapered region;

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber; and wherein each optical fiber is adapted to receive an optical input from a plurality of optical inputs at the second end; and wherein the plurality of optical inputs are emitted into free space at the facet as a single combined optical output. "

The Examiner argues that Russell discloses a combiner having a very similar structure to that of Wong, where an optical input may be provided to a plurality of unfused fibers and combined into a single output at a facet, and maintains that it would have been obvious to use the splitter of Wong as a combiner, as is described by Russel, as doing so will increase the overall usability and functionality of the device, allowing the apparatus of Wong to bi-directionally function not only as a multiplexer, but also as a demultiplexer. The Appellants respectfully disagree.

Independent claim 5 recites, in part, a "plurality of optical inputs are emitted into free space at the facet as a single combined optical output". As Appellants previously argued in the Amendment and Response filed May 7, 2007, Wong discloses unambiguously that an essential feature of its invention is that an individual single-mode optical fiber has a junction end juxtaposed, through a focusing lens/junction element, to the end of the bundle of fiber. The skilled reader readily understands that the individual single-mode fiber and the focusing lens/junction element physically prevent emitting light from the facet into free space.

Since the individual single-mode optical fiber and the focusing lens/junction element juxtaposed to the end of the bundle of fibers are essential features of Wong, it would not be obvious to cancel the single-mode optical fiber and focusing lens/junction element from Wong, whereby it is not obvious to modify Wong so as to be able to emit a single combined optical output at the facet into free space. It follows that claim 5, reciting a "plurality of optical inputs are emitted into free space at the facet as a single combined optical output", is new and non obvious in view of the applied art.

Wong recites in each of its independent claims that the bundle of fibers is juxtaposed/joined to an individual single-mode optical fiber through a focusing lens/junction element. The Appellants note that by doing so Wong unambiguously discloses that the feature of the bundle being juxtaposed, through a focusing lens/junction element, to the individual single-mode fiber is an essential feature of its device. As detailed in the Amendment and response dated May 7, 2007, canceling an essential feature from Wong would render Wong unsatisfactory for its intended purpose. It follows that it cannot be argued that there is any suggestion in the prior art to modify Wong by canceling the essential feature of the individual single-mode fiber and focusing lens/junction element juxtaposed to the bundle.

The Examiner has responded to Appellants' previous arguments by stating "Figure 9 of Wong shows the tapered fiber bundle where the facet is unattached to another fiber, and therefore capable of transmitting/receiving an optical signal from free space at the facet." It is respectfully brought to the Examiner's attention that Figure 9 shows but one step, step 4, in the construction of Wong's splitter, not a working device, and certainly not an embodiment of his

invention combinable with any other art (Wong, column 3, lines 31-32). Wong does not teach or suggest that the partially constructed splitter shown in Figure 4 can, or could, be usable in any way or for any purpose. The Examiner is, at best, using impermissible hindsight in making the rejection, and at best is putting forth unsubstantiated conjecture.

The Examiner has not established a *prima facie* case of obviousness at least because the combination of Wong and Russell, whether or not a teaching, suggestion or motivation to combine exists, does not teach or suggest the claimed subject matter of claim 5. M.P.E.P. § 2143.03 ("To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art").

The rejection of claim 5 under 35 U.S.C. § 103(a) should be reversed and withdrawn.

Claim 14

Independent claim 14 is directed to:

"A method for coupling light comprising:

providing a plurality of optical fibers, each optical fiber having a first end, a second end, and a central core extending between the first and second end;

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section;

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber;

forming a facet by cutting and polishing or by cleaving said

fused section in a direction perpendicular to the core; and
illuminating the facet with the light, wherein said illuminating further comprises:
providing an optical input at the second end of each optical fiber; and
emitting the optical inputs as a single combined optical output at the facet into free space."

The Examiner argues that Russell discloses a combiner having a very similar structure to that of Wong, where an optical input may be provided to the plurality of unfused fibers and combined into a single output at the facet, and further maintains that it would have been obvious to use the splitter of Wong as a combiner, as is described by Russell, as doing so will increase the overall usability and functionality of the device, allowing the apparatus of Wong to bi-directionally function not only as a multiplexer, but also as a demultiplexer. The Appellants again respectfully disagree.

Independent claim 14 recites, in part, "emitting the optical inputs as a single combined optical output at the facet into free space." As Appellants previously argued in the Amendment and Response filed May 7, 2007, Wong discloses unambiguously that an essential feature of its invention is that an individual single-mode optical fiber has a junction end juxtaposed, through a focusing lens/junction element, to the end of the bundle of fiber. The skilled reader readily understands that the individual single-mode fiber and the focusing lens/junction element physically prevent emitting light from the facet into free space.

Since the individual single-mode optical fiber and the focusing lens/junction element juxtaposed to the end of the bundle of fibers are essential features of Wong, it would not be obvious to cancel the single-mode optical fiber

and focusing lens/junction element from Wong, whereby it is not obvious to modify Wong so as to be able to emit a single combined optical output at the facet into free space. It follows that claim 14, reciting "*emitting the optical inputs as a single combined optical output at the facet into free space*", is new and non obvious in view of the applied art.

Wong recites in each of its independent claims that the bundle of fibers is juxtaposed/joined to an individual single-mode optical fiber through a focusing lens/junction element. The Appellants again note that by doing so Wong unambiguously discloses that the feature of the bundle being juxtaposed, through a focusing lens/junction element, to the individual single-mode fiber is an essential feature of its device. As detailed in the Amendment and response dated May 7, 2007, canceling an essential feature from Wong would render Wong unsatisfactory for its intended purpose. It follows that it cannot be argued that there is any suggestion in the prior art to modify Wong by canceling the essential feature of the individual single-mode fiber and focusing lens/junction element juxtaposed to the bundle.

The Examiner responds to Appellants' previous arguments by stating "Figure 9 of Wong shows the tapered fiber bundle where the facet is unattached to another fiber, and therefore capable of transmitting/receiving an optical signal from free space at the facet." It is respectfully brought to the Examiner's attention that Figure 9 shows but one step, step 4, in the construction of Wong's splitter, not a working device, and certainly not an embodiment of his invention combinable with any other art (Wong, column 3, lines 31-32). Wong does not teach or suggest that the partially constructed splitter shown in Figure 4 can, or could, be usable in any way or for any purpose. The Examiner is, at best, using impermissible hindsight in making the rejection, and at best is putting forth

unsubstantiated conjecture.

The Examiner has not established a *prima facie* case of obviousness at least because the combination of Wong and Russell, whether or not a teaching, suggestion or motivation to combine exists, does not teach or suggest the claimed subject matter of claim 14. M.P.E.P. § 2143.03 ("To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art").

The rejection of claim 14 under 35 U.S.C. § 103(a) should be reversed and withdrawn.

Issue 4: The Rejection under 35 U.S.C. § 103(a) over Wong

The Examiner rejects claims 2-4, 8, 10-13, 17, 19, 28 and 30 under 35 U.S.C. § 103(a) as being unpatentable over Wong. This rejection should be withdrawn because Wong does not teach or suggest the claimed subject matter.

Independent Claims

Claims 11 and 28 are independent.

Claim 11

Claim 11 recites a "method for coupling light" requiring:

> "providing a plurality of optical fibers, each optical fiber having a first end, a second end, and a central core extending between the first and second end;
> fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section;
> tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering

the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber;

forming a facet by cutting and polishing or by cleaving said fused section in a direction perpendicular to the core; and

illuminating the facet with the light, wherein said illuminating further comprises:

illuminating the facet with a single optical input traveling in free space; and

distributing the single optical input amongst each optical fiber in the plurality of optical fibers to provide a plurality of distributed optical outputs."

Independent claim 11 recites, in part, ""illuminating the facet with a single optical input traveling in free space". The Examiner acknowledges that Wong does not disclose the facet receiving an optical signal via free space, but instead teaches an input being received from another optical fiber. The Examiner further argues "being that the apparatus is capable of receiving an optical input, it would have been obvious to one of ordinary skill in the art to use any optical source in conjunction with the apparatus, including an optical signal propagating in free space." The Appellants respectfully disagree.

As Appellants previously noted, Wong recites in each of its independent claims (1, 4 and 6) that the bundle of fibers is juxtaposed/joined to an individual single-mode optical fiber through a focusing lens/junction element. The Appellants again note that by doing so Wong unambiguously discloses that the feature of the bundle being juxtaposed, through a focusing lens/junction element, to the individual single-mode fiber is an essential feature of its device. As detailed in the Amendment and response dated May 7, 2007, canceling an essential feature from Wong would render Wong unsatisfactory for its intended

purpose. It follows that it cannot be argued that there is any suggestion in the prior art to modify Wong by canceling the essential feature of the individual single-mode fiber and focusing lens/junction element juxtaposed to the bundle.

The skilled reader readily understands that the individual single-mode fiber and the focusing lens/junction element physically prevent from illuminating the facet of the bundle with a single optical input traveling in free space. It follows that illuminating the facet of the bundle with a single optical input traveling in free space is non obvious over Wong, at least because it would require a non obvious modification of Wong.

The Examiner responds to Appellants' previous arguments by referencing Figure 9 as done so in responding to Appellants' previous arguments regarding claims 5 and 14. We respectfully reiterate that stated above, namely, that the referenced Figure 9 shows but one step, step 4, in the construction of Wong's splitter (Wong, column 3, lines 31-32). Wong does not teach or suggest that the partially constructed splitter shown in Figure 4 can, or could, be usable in any way. The Examiner is, at best, using impermissible hindsight in making this rejection, and at best is putting forth pure conjecture.

The Examiner has not established a *prima facie* case of obviousness at least because it would not have been obvious to modify Wong as proposed by the Examiner.

The rejection of claim 11 under 35 U.S.C. § 103(a) should be reversed and withdrawn.

Claim 28

Claim 28 recites a "fiber optic apparatus" requiring:

> "a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and
>
> a facet, said facet being formed by cutting and polishing or by cleaving said tapered region;
>
> wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber; wherein the facet is adapted to receive a single optical input traveling in free space, the fibers having each a core and a cladding and a mode shape, the sum of the mode shapes of the fibers being calculated, and the core/cladding size ratio and stretch being selected, to maximize coupling of the free space beam into the core ensemble; the single optical input being distributed amongst each optical fiber in the plurality of optical fibers."

Independent claim 28 recites, in part, "the facet is adapted to receive a single optical input traveling in free space, the fibers having each a core and a cladding and a mode shape, the sum of the mode shapes of the fibers being calculated, and the core/cladding size ratio and stretch being selected, to maximize coupling of the free space beam into the core ensemble".

As previously discussed, Wong recites in each of its independent claims (1, 4 and 6) that the bundle of fibers is juxtaposed/joined to the individual single-mode optical fiber through a focusing lens/junction element. Appellants reiterate that by doing so Wong unambiguously discloses that the feature of the bundle being juxtaposed, through a focusing lens/junction element, to the individual single-mode fiber is an essential feature of Wong's invention.

As previously detailed, the Appellants respectfully submit that a device

modified so that it does not comprise all the essential features of Wong would not be within the scope of Wong's invention and would be unsatisfactory for the intended purpose of the invention of Wong. It follows that it cannot be argued that there is any suggestion in the prior art to modify Wong by canceling Wong's essential feature of the individual single-mode fiber and focusing lens/junction element being juxtaposed to the bundle.

On another hand, the skilled reader readily understands that the individual single-mode fiber and the focusing lens/junction element physically prevent from illuminating the facet of the bundle with a single optical input traveling in free space. It follows that illuminating the facet of the bundle with a single optical input traveling in free space is non obvious over Wong, at least because it would require a non obvious modification of the invention of Wong. It also follows that it is also not obvious to modify the device of Wong to maximize coupling of a free space beam with the bundle; and in particular by calculating the sum of the mode shapes of the fibers and selecting the core/cladding size ratio and stretch to maximize coupling of the free space beam into the core ensemble.

The Examiner has chosen to ignore certain features recited in claim 28. Namely, the requirement that "the sum of the mode shapes of the fibers being calculated, and the core/cladding size ration and stretch being selected, to maximize coupling of the free space beam into the core ensemble" has not been given its full due. The Examiner states "claim 28 only requires the device to be formed such that the coupling of the free space beam is maximized." For this, the Examiner again relies upon *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ 2d 1429, 1431-32 (Fed. Cir. 1997). It is respectfully asserted that the Examiner has misapplied *Schreiber*. *Schreiber* teaches that an apparatus must be distinguished

from the prior art in terms of structure rather than function. The ignored language is not functional language, but rather language that clearly and specifically defines structure of the claimed fiber optic apparatus. Accordingly, the neglected portion of claim 28 should clearly have been considered. The Examiner's attention is again directed to *Hewlett-Packard Co. v. Bausch & Lomb Inc.* in which the court stated "[A]pparatus claims cover what a device *is*, not what a device *does*." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original). Clearly, the ignored language is directed to what the claimed fiber optic apparatus is, not what the claimed fiber optic apparatus does. At a minimum, the rejection of claim 28 is improper based upon the Examiner's failure to consider language which defines structure.

The Examiner responds to the Appellants' prior arguments by reference to Figure 9. We again respectfully reiterate that stated above regarding the Examiner's reliance upon Figure 9. Figure 9 shows but one step, step 4, in the construction of Wong's splitter (Wong, column 3, lines 31-32). Wong does not teach or suggest that the partially constructed splitter shown in Figure 4 can, or could, be usable in any way, or for any purpose. The Examiner is, at best, using impermissible hindsight in making this rejection, and at best is putting forth unsubstantiated conjecture.

The Examiner has not established a *prima facie* case of obviousness at least because the proposed modification of Wong cannot be made, and further because Wong does not teach or suggest the claimed subject matter of claim 28. M.P.E.P. § 2143.03 ("To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art").

The rejection of claim 28 under 35 U.S.C. § 103(a) should be reversed and

withdrawn.

Dependent Claims

Claims 2-4, 8, 10 and 30 depend directly from independent claim 28.

Claims 12, 13, 17 and 19 depend directly or indirectly from independent claim 11.

The rejections of these claims under 35 U.S.C. § 103(a) are all based on Wong. Claims 2-4, 8, 10 and 30 are allowable as dependent claims at least in view of the allowability of claim 28 over these references and without considering the additional limitations added by these claims. Claims 12, 13, 17 and 19 are allowable as dependent claims at least in view of the allowability of claim 11 over these references and without considering the additional limitations added by these claims.

Claim 2

Appellants submit that claim 2, in addition to being allowable based upon its dependency on claim 28, is also allowable for the following reasons.

Claim 2 requires: "wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays."

The Examiner contends that the limitations of claim 2 are taught by Wong. The Appellants respectfully disagree.

For example, the Examiner argues that Figures 2 and 3 of Wong show fibers 12-19 arranged in a close-packed hexagonal array. It is respectfully submitted that while eight fibers are indeed shown in Figures 2 and 3, Wong

does **not** disclose or otherwise suggest "hexagonal close packed arrays" as recited in claim 2. Nor does Wong teach or suggest "square close packed arrays", or "three-nearest neighbor packed arrays", as also recited in claim 2. Further still, Wong teaches that its fibers are of an arbitrarily large number and are arbitrarily grouped together (see, for example, column 3, lines 49 and 50). Further still, Figures 2 and 3 show the fibers not packed in any manner.

For at least this reason, the Section 103(a) rejection of claim 2 over Wong should be reversed and withdrawn.

Claim 3

Appellants submit that claim 3, in addition to being allowable based upon its dependency on claim 28, is also allowable for the following reasons.

Claim 3 requires: ", wherein the plurality of optical fibers is provided in a glass matrix."

The Examiner contends that the limitation of claim 3 are taught by Wong. The Appellants respectfully disagree. As discussed above, the Examiner relies upon detail 53 of Wong as being a "glass matrix." However, also as discussed above, detail 53 is, instead, a quartz tube. Wong fails to teach or suggest a glass matrix. For at least this reason, the Section 103(a) rejection of claim 3 over Wong should be reversed and withdrawn.

Claim 4

Appellants submit that claim 4, in addition to being allowable based upon its dependency on claim 28, is also allowable for the following reasons.

Claim 4 requires: "wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region."

The Examiner contends that the limitations of claim 4 are inherent to Wong. The Appellants respectfully disagree.

The Examiner argues "in the fusing and stretching method disclosed above by Wong, it is inherent that the core size of a given fiber within the taper portion is smaller than the core diameter of the same given fiber in the non-tapered (non-stretched) portion." Appellants note that the above logic at best relates to the overall dimensions of a fiber optic bundle, and does not relate to the core diameter of the fibers of the bundle. Accordingly, Appellants respectfully submit that the Examiner has failed to show that Wong inherently discloses or suggests that recited in claim 4. Appellants submit that for at least this reason, claim 23 is patentable over the applied art, whereby the Examiner's rejection should be properly overturned.

The Section 103(a) rejection of claim 4 over Wong should be reversed and withdrawn.

Claim 8

Appellants 8 depends from claim 28. Claim 8 is allowable as a dependent claim at least in view of the allowability of claim 28 over the references and without considering the additional limitations added by claim 8.

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d

1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 8 also allowable.

Claim 10

Appellants submit that claim 10, in addition to being allowable based upon its dependency on claim 28, is also allowable for the following reasons.

Claim 10 requires: "wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers."

The Examiner contends that the limitations of claim 10 are taught by Wong, relying upon the disclosure therein at column 3, lines 49-58. The Appellants respectfully disagree. While it is true that Wong discloses fibers having a range of core sizes, he does **not** disclose that "at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers". Appellants note that at most Wong teaches that the individual optical fibers used may have core sizes in a given range, but does not teach that one ore more fibers may each have a different core size from the other fibers. Thus, for at least this reason alone, Wong does not teach or suggest the claimed subject matter of claim 10 and the Section 103(a) rejection of claim 10 over Wong should thus be reversed and withdrawn.

Claim 12

Appellants submit that claim 12, in addition to being allowable based upon its dependency on claim 11, is also allowable for the following reasons.

Claim 12 requires: "arranging the plurality of optical fibers in an array; and disposing the plurality of optical fibers in a glass matrix."

The Examiner contends that the limitations of claim 12 are taught by Wong. The Appellants respectfully disagree.

As will be understood from the discussion above, Wong does **not** teach or suggest fibers arranged in an array, nor does it teach or suggest a glass matrix. Wong's fibers are arbitrarily arranged in a quartz tube. Thus, Wong fails to teach or suggest that explicitly recited by claim 12. For this reason alone, the Section 103(a) rejection of claim 12 over Wong should be reversed and withdrawn.

Claim 13

Appellants submit that claim 13, in addition to being allowable based upon its dependency on claim 11, is also allowable for the following reasons.

Claim 13 requires: "wherein the array is selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays."

The Examiner contends that the limitations of claim 13 are taught by Wong. As will be understood by the discussion above, the Appellants respectfully disagree because Wong does not teach or suggest a packed array arrangement of any kind. Rather, Wong discloses an arbitrary arrangement of an arbitrary number of fibers. Accordingly, the Section 103(a) rejection of claim 13 over Wong should be reversed and withdrawn.

Claim 17

Appellants 17 depends from claim 11. Claim 17 is allowable as a dependent claim at least in view of the allowability of claim 11 over the references and without considering the additional limitations added by claim 17.

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 17 also allowable.

Claim 19

The rejection should be withdrawn because, in addition to being allowable based upon its dependency on claim 11, Wong does not teach or suggest the claimed subject matter.

Claim 19 requires: "wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers."

The Examiner contends that the limitations of claim 19 are taught by Wong, relying upon the disclosure therein at column 3, lines 49-58. The Appellants respectfully disagree. While it is true that Wong discloses fibers having a range of core sizes, he does **not** disclose that "at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers". Appellants note that at most Wong teaches that the individual optical fibers used may have core sizes in a given range, but does not teach that one ore more fibers may each have a different core size from the other fibers. Thus, for at least this reason alone, Wong does not teach or suggest the claimed subject matter of claim 19 and

the Section 103(a) rejection of claim 19 over Wong should thus be reversed and withdrawn.

Claim 30

Appellants 30 depends from claim 28. Claim 30 is allowable as a dependent claim at least in view of the allowability of claim 28 over the references and without considering the additional limitations added by claim 30.

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 30 also allowable.

Issue 5: The Rejection under 35 U.S.C. § 103(a) over Wong and Berkey

The Examiner rejects claims 7 and 16 under 35 U.S.C. § 103(a) as being unpatentable over Wong in view of Berkey. This rejection should be withdrawn because neither Wong nor Berkey, whether singly or in combination, teach or suggest the claimed subject matter.

Claim 7 depends from claim 3, which depends from independent claim 28. Claim 7 is allowable as a dependent claim at least in view of the allowability of claim 28 over these references and without considering the additional limitations added by either of claims 3 or 7. Additionally, claim 7 is allowable as a dependent claim in view of the allowability of claim 3 over these references and without considering the additional limitations added by claim 7.

Claim 16 depends from claim 12, which depends from independent claim

11. Claim 16 is allowable as a dependent claim at least in view of the allowability of claim 11 over these references and without considering the additional limitations added by either of claims 12 or 16. Additionally, claim 16 is allowable as a dependent claim in view of the allowability of claim 12 over these references and without considering the additional limitations added by claim 16.

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 7 and 16 are also allowable.

CONCLUSION

For the extensive reasons advanced above, Appellants respectfully contend that each claim is patentable. Therefore, reversal of the above-addressed rejections and objections and re-opening of the prosecution is respectfully solicited.

The Commissioner is authorized to charge any additional fees that may be required or credit overpayment to deposit account no. 12-0415. In particular, if this response is not timely filed, the Commissioner is authorized to treat this response as including a petition to extend the time period pursuant to 37 CFR 1.136(a) requesting an extension of time of the number of months necessary to make this response timely filed and the petition fee due in connection therewith may be charged to deposit account no. 12-0415.

Respectfully submitted,

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CLAIMS APPENDIX

1. A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region, wherein the second end of the fibers are detached from each other; and

a facet, said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis; said facet having a cross section other than approximately equal to the cross section of an individual single-mode fiber.

2. The apparatus of claim 28, wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays.

3. The apparatus of claim 28, wherein the plurality of optical fibers is provided in a glass matrix.

4. The apparatus of claim 28, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region.

5. A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cutting and polishing or by cleaving said tapered region;

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber; and wherein each optical fiber is adapted to receive an optical input from a plurality of optical inputs at the second end; and

wherein the plurality of optical inputs are emitted into free space at the facet as a single combined optical output.

6. (canceled)

7. The apparatus of claim 3, wherein the glass matrix is comprised of fluorosilicate.

8. The apparatus of claim 28, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber.

9. The apparatus of claim 1, wherein the plurality of optical fibers disposed in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber.

10. The apparatus of claim 28, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one

other optical fiber of the plurality of optical fibers.

11. A method for coupling light comprising:

providing a plurality of optical fibers, each optical fiber having a first end, a second end, and a central core extending between the first and second end;

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section;

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber;

forming a facet by cutting and polishing or by cleaving said fused section in a direction perpendicular to the core; and

illuminating the facet with the light, wherein said illuminating further comprises:

illuminating the facet with a single optical input traveling in free space; and

distributing the single optical input amongst each optical fiber in the

plurality of optical fibers to provide a plurality of distributed optical outputs.

12. The method of claim 11, further comprising the steps of:

arranging the plurality of optical fibers in an array; and

disposing the plurality of optical fibers in a glass matrix.

13. The method of claim 12, wherein the array is selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays.

14. A method for coupling light comprising:

providing a plurality of optical fibers, each optical fiber having a first end, a second end, and a central core extending between the first and second end;

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section;

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of

optical coupling between each optical fiber;

forming a facet by cutting and polishing or by cleaving said fused section in a direction perpendicular to the core; and

illuminating the facet with the light, wherein said illuminating further comprises:

providing an optical input at the second end of each optical fiber; and

emitting the optical inputs as a single combined optical output at the facet into free space.

15. (canceled)

16. The method of claim 12, wherein the glass matrix comprises fluorosilicate.

17. The method of claim 11, wherein the optical input has diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber.

18. (canceled)

19. The method of claim 11, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers.

20. An apparatus for coupling light comprising:

a plurality of single mode optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cutting and polishing or by cleaving the tapered region in a direction perpendicular to said fiber axis, wherein the facet is adapted to receive a single optical input, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber; said facet having a cross section other than approximately equal to the cross section of an individual single-mode

fiber.

21. The apparatus of claim 20, wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays.

22. The apparatus of claim 20, wherein the plurality of optical fibers are provided in a glass matrix.

23. The apparatus of claim 20, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region.

24. The apparatus of claim 22, wherein the glass matrix is comprised of fluorosilicate.

25. The apparatus of claim 20, where the fibers have each a core and a cladding and a mode shape; the plurality of optical fibers in the fused section are

uniformly stretched to provide a desired amount of optical coupling between each optical fiber; and where the sum of the mode shapes of the fibers is calculated, and the core/cladding size ratio and stretch are selected, to maximize coupling of the free space beam into the core ensemble.

26. The apparatus of claim 20, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers.

27. A fiber optic apparatus comprising:

a plurality of single mode silica optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cutting and polishing or by cleaving said tapered region in a direction perpendicular to said fiber axis; wherein said facet has a cross section other than approximately equal to the cross section of an individual single-mode fiber.

28. A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cutting and polishing or by cleaving said tapered region;

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber; wherein the facet is adapted to receive a single optical input traveling in free space, the fibers having each a core and a cladding and a mode shape, the sum of the mode shapes of the fibers being calculated, and the core/cladding size ratio and stretch being selected, to maximize coupling of the free space beam into the core ensemble; the single optical input being distributed amongst each optical fiber in the plurality of optical fibers.

29. (canceled)

30. The fiber optic apparatus of claim 28, wherein said facet has a direction perpendicular to said fiber axis.

31. The fiber optic apparatus of claim 27, where the fibers have each a core and a cladding and a mode shape; where the plurality of optical fibers in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber; and where the sum of the mode shapes of the fibers is calculated, and the core/cladding size ratio and stretch are selected, to maximize coupling of the free space beam into the core ensemble.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.